Center Independent Research & Development: GRC IRAD

FY17 GRC: Long-Life Environmental Barrier Coatings Technology

Completed Technology Project (2017 - 2017)

Project Introduction

The NASA Aeronautic research strategy is to develop and demonstrate revolutionary technologies that enable global air transportation that is safer, more efficient, and more environmentally friendly for the next 30 years and beyond. Increased fuel efficiency is a game changer in gas turbines as fuel is the single most important cost, accounting for up to about 40% of the overall operation cost of commercial aircrafts. Increased fuel efficiency is obtained through increasing the thermal efficiency of the engine by increasing the overall pressure ratio (OPR). Increased OPR requires increased turbine inlet temperature, which is paced by advances in turbine hot section materials temperature capability. High turbine inlet temperature also contributes to environmentally friendly engines by reducing NOx. SiC/SiC Ceramic Matrix Composites (CMCs) are the most promising materials to revolutionize the temperature capability of turbine hot section materials because of their high temperature mechanical properties and oxidation resistance in dry air. The goal of this project was the infusion of 2700 ^{O}F CMCs, which represents daunting challenges as failure of EBC means rapid reduction in CMC component life.

Anticipated Benefits

The global increase in air travel will require commercial vehicles to be more efficient than ever before. Advanced engine hot section materials technology is required to keep the fuel consumption and emission to a minimum. The project is unique in that it addresses multiple technical issues using a balanced mix of science, engineering, manufacturing, and testing. Long-life next generation EBCs, by enabling 2700 ^{O}F CMCs, enable a 6% reduction in fuel burn, enable combustor liners required to reduce NOx emissions to 80% below the CAEP6 standard, and enable a reduced size turbines with 50+ OPR. The EBC alloy technology promises to be a paradigm shifting technology for next generation gas turbines by providing a quantum leap in EBC life. The projected benefits in 5-10 years include a step change in current EBC reliability. The projected benefits in 10-20 years include the infusion of 2700 ^{O}F CMCs in next generation gas turbines.

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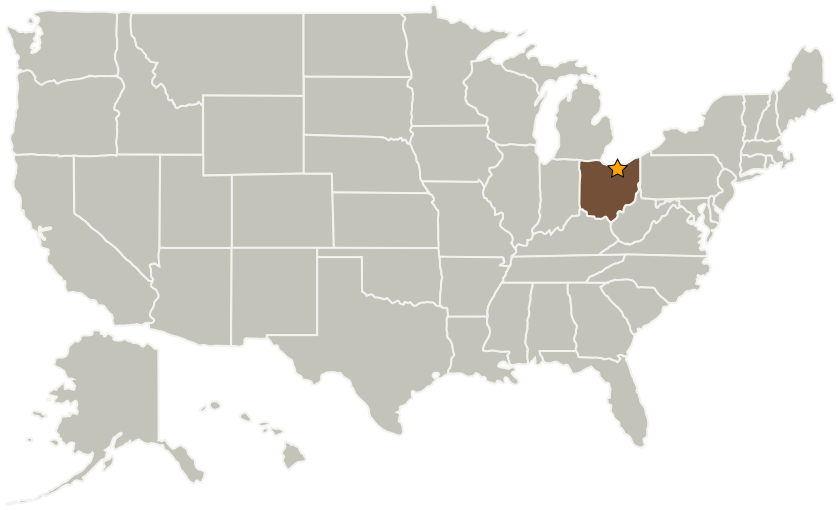
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
California Institute of Technology(CalTech)	Supporting Organization	Academia	Pasadena, California

Primary U.S. Work Locations
Ohio

Project Transitions

May 2017: Project Start

November 2017: Closed out

Closeout Summary: GRC considers this technology to be ready for adoption wi thin the Aeronautics program/project portfolio. The GRC Aeronautics Directorate will support the accomplishment of this objective.

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Center Independent Research & Development: GRC IRAD

Project Management

Program Manager:

Gary A Horsham

Project Manager:

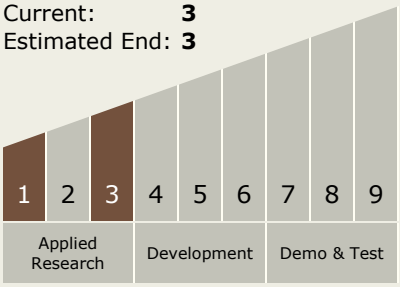
Kang N Lee

Principal Investigator:

Kang N Lee

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.3 Aero Propulsion
    - TX01.3.1 Integrated Systems and Ancillary Technologies

Target Destination

Earth

Supported Mission Type

Push